NOAA Technical Memorandum NMFS

NOVEMBER 1995

GUIDELINES FOR HANDLING MARINE TURTLES HOOKED OR ENTANGLED IN THE HAWAII LONGLINE FISHERY: RESULTS OF AN EXPERT WORKSHOP HELD IN HONOLULU, HAWAII MARCH 15-17, 1995

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NOAA-TM-NMFS-SWFSC-222

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southwest Fisheries Science Center

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INTRODUCTION

Background and Rationale

Mortality and injury of sea turtles resulting from incidental capture in various commercial fisheries are widely recognized as important issues to the recovery and long-term conservation of these threatened and endangered species (NMFS/FWS 1991a, 1991b, 1992). All sea turtles under U.S. jurisdiction are listed and protected under the Endangered Species Act of 1973. Forced submergence in shrimp trawls in the southeastern United States and elsewhere worldwide has been a focus of research and mitigation efforts during recent years. However, the urgent need has also been emphasized to closely examine the bycatch of sea turtles by other fishing gear, such as coastal set nets, high-seas driftnets, purse seines, and longlines (National Research Council, 1990). Sea turtles incidentally hooked or entangled in pelagic habitats of the North Pacific by the Hawaii-based longline fishery are an issue of continuing concern and investigation (Balazs and Pooley, 1994).

Cases of sea turtles ingesting baited longline hooks or becoming entangled or hooked externally have been known to the scientific community for over a decade (Hillestad et al., 1982; Limpus, 1984; Balazs, 1982; Witzell, 1984). Skillman and Balazs (1992) provided the most detailed documentation to date involving hooking of a large leatherback (Dermochelys coriacea) that swallowed squid bait on swordfish longline gear during research fishing in the North Pacific. In addition, the swallowing dynamics of sea turtles in relation to hooking in the esophagus or stomach have been described (White, 1994). In spite of such records, the actual number of turtles captured on longline gear (both domestic and foreign), the level of injury and mortality caused by these interactions, and the resulting impact to the affected stocks are virtually unknown. The limited information available on this subject for the Hawaii-based longline fishery has been summarized in formal Section 7 Biological Opinions and associated reports (NMFS, 1993, 1994, 1995).

Turtles taken by longline gear may be alive or dead, or appear dead but actually comatose, when hauled aboard or along side a fishing vessel during gear retrieval. Additional injury may occur during the hauling process. Death or damage may result from forced submergence, or from the hook penetrating an internal organ or major blood vessel, or from subsequent infection. Live turtles with hooks deep in their throat may be cut free by the fishermen and released with varying lengths of line trailing from the mouth or body. Later, this line may be ingested or entangled on the turtle's appendages or neck, thereby inflicting damage or eventual death by strangulation.

Participants of an earlier workshop convened to address research methods for hooking mortality have emphasized the need to formulate handling and treatment techniques for turtles hooked and entangled by longlining (Balazs and Pooley, 1994). In addition, NMFS (1994) subsequently mandated that a workshop be convened to evaluate procedures for handling and caring for live turtles taken by longlining. Such a meeting was one of several "Reasonable and Prudent Measures" listed in the Incidental Take Statement issued pursuant to Section 7 (b) of the Endangered Species Act for the long-term operation of the Hawaii-based longline fishery. The present report provides a description of that workshop and the findings that resulted.

Expert Workshop

A workshop to develop guidelines for handling hooked and entangled turtles was hosted by the NMFS Honolulu Laboratory March 15-17, 1995. The workshop was convened by George Balazs of the NMFS Honolulu Laboratory's Protected Species Investigation. Samuel Pooley, Industry Economist at the Honolulu Laboratory, served as the moderator for the workshop planning process. Participants included NMFS longline at-sea observers, marine turtle veterinarians, and marine turtle biologists. Longline fishing industry members and staff of the Western Pacific Regional Fishery Management Council participated in part of the workshop. A scientist and a fishing industry specialist from Japan also participated. Appendix A provides a list of the participants. Certain Hawaii longline fishermen were later asked to provide comments on a summary of the workshop recommendations. A summary of their comments is given in Appendix B.

The workshop involved a combination of scientific presentations on the Hawaii longline fishery and interactions with turtles, as well as the insights of professional veterinarians in dealing with hooking and related injuries in marine turtles. Two of these presentations appear in Appendix C in order to give the reader basic background information used by participants to formulate the recommended handling guidelines that form the basis of this report.

A structured strategic planning process was used to conduct the workshop. This process involved the Nominal Group Technique for generating ideas for guidelines to address the problem of hooked or entangled turtles. The use of this technique is discussed in Appendix D. The Nominal Group Technique session focused on the following "trigger" question:

> **What are the most important <u>practical</u> steps which can be taken to improve the survivability of turtles hooked or entangled in the Hawaii longline fishery?"**

The responses to this question were separated into activities which fishing vessel captains might be expected to conduct, and those which NMFS observers could conduct if they were aboard the vessel. The responses were then analyzed by three working groups emphasizing different phases of longline fishing and the turtle handling process; that is, retrieval of the gear, treatment of the hooked turtles by fishermen, and treatment of hooked turtles by NMFS at-sea observers, when such observers are aboard a vessel. The resulting practical recommendations are contained in the following sections.

GUIDELINES FOR RETRIEVAL OF HOOKED/ENTANGLED SEA TURTLES

1. Equip all vessels with "cut out doors".

   Advantage: To facilitate handling and boarding of turtles in order to reduce further injury. To minimize distance from the water for retrieving and releasing turtles.

   Disadvantage: Expensive if vessel is not already equipped. Possible safety problem for crew.

2. Scan main line as far ahead as possible in order to sight turtles in advance.

   Advantage: Improve reaction time by vessel. Minimize trauma to turtle. Reduce possibility of turtle being jerked out of the water and pulled across the surface.

   Disadvantage: Increased crew time required.

3. Effort should be made not to get ahead of the main line while picking up gear.

   Advantage: Better chance of sighting turtle and less chance of fouling or running over gear and turtle. Reduce trauma to turtle and possibility of turtle being jerked out of the water.

   Disadvantage: None identified.

4. Immediately upon sighting turtle (any distance from current position), slow vessel and main line reel speed, adjust direction of vessel to move toward the turtle, minimize tension on main line and leader line with turtle.

   Advantage: Reduced tension on leader line thereby minimizing trauma or further damage to turtle. Avoid "setting" the hook.

   Disadvantage: Time consuming, reduces vessel maneuverability, and increases possibility of gear entanglement with vessel.

5. Once snap of leader containing turtle is in hand, continue to move toward turtle at as slow a speed as possible. If not possible, STOP vessel, take engine out of gear and retrieve turtle. Stop vessel and take out of gear once turtle is brought alongside.

   Advantage: Minimize trauma/further damage to turtle.

   Disadvantage: Reduced vessel maneuverability.

GUIDELINES FOR RETRIEVAL OF HOOKED/ENTANGLED SEA TURTLES...cont.

6. Retrieve leader with turtle slowly, keeping a gentle, consistent tension on the line. Avoid tugging or yanking line quickly. No gaffs or sharp objects should be used in retrieval of turtle.

   Advantage: Increased ease in handling, avoid setting hook further, and reduced damage to turtle.

   Disadvantage: None identified.

7. Ensure that enough slack or play is left in the line to keep turtle near vessel yet in the water until turtle is brought on board or released.

   Advantage: Reduce trauma and avoid setting hook further.

   Disadvantage: Crew will need to be experienced.

   NOTE: VESSEL SHOULD REMAIN STOPPED AND IN NEUTRAL GEAR UNTIL TURTLE IS SAFELY AWAY FROM VESSEL.

8. Assess turtle condition and size. Is it dead or alive? Hooked or entangled? If hooked, is the hook ingested or external? How large is the turtle?

   Advantage: Reduce further injury to turtle, minimize chance of injury to crew, decision to release-at-sea or bring on board vessel.

   Disadvantage: None identified.

9. If turtle is small, bring on board immediately using suitable dip net or other lifting device.

10. If the turtle is too large to safely board (even with dip net) without causing further damage/injury to turtle, then:

    a. If entangled (alive) and not hooked--Use clippers to clip line and remove line to release turtle. Do NOT leave any line attached to turtle.

    b. If hooked externally (flipper/neck/carapace)--Remove hook. If not possible, then cut line at eye of hook (or as close to eye of hook as possible), free turtle of all line, and release.

    c. If hooked internally or in beak--Cut leader as close to eye of hook as possible, leaving as little line attached as possible.

GUIDELINES FOR RETRIEVAL OF HOOKED/ENTANGLED SEA TURTLES...cont.

11. Boarding turtle--Do NOT use leader line, gaff or other sharp objects to assist bringing turtle on board vessel. Lift turtle onto deck using carapace, flippers, or with the assistance of a large dip net. It is recommended that all vessels have such nets on board to use for turtle retrieval.

12. Release of turtle: Vessel should be stopped and in neutral gear before releasing turtle.

    a. Ease turtle gently into water, head first through cut out door, if so equipped.

    b. Observe that turtle is safely away from vessel before engaging propeller and continuing operations.

       Advantage: Reduce trauma to turtle and possibility of injury from impact with propeller or hull of vessel.

       Disadvantage: Additional time needed.

GUIDELINES FOR TREATMENT OF HOOKED/ENTANGLED SEA TURTLES BY FISHERMEN

1. Assess turtle's condition.

   a. Determine if turtle is dead or alive.

   b. If there is no visible movement then:

      (1) Touch the eye and pinch the tail.

      Advantage: Easily accessible reflex test with high sensitivity.

      Disadvantage: Test is less sensitive than using a Doppler device to detect pulse. However, Doppler device is expensive.

      (2) If there is no response, set the turtle aside for up to 24 hours in a shaded, protected area, and cover with a moist cloth. Elevate its hindquarters several inches.

      (3) Check the turtle periodically with the reflex test.

   c. If the turtle is determined dead:

      (1) Remove line and hook from turtle.

      (2) Current regulations require dead turtles to be returned to the sea immediately, following a determination of death.

   d. If unsure that turtle is dead, the following should be carried out:

      (1) Touch the eye and pinch the tail periodically up to 24 hours to see if there is a response.

   e. If turtle is responsive it should be placed in a shaded, protected area and covered with a moist cloth and checked periodically up to 24 hours, at which time it should be returned to the sea.

   Advantage: Maximize possibility of turtle surviving.

   Disadvantage: Additional crew time needed.

f. Active turtles.

(1) Remove line from turtle.

Advantage: To prevent further injury, as monofilament line remaining on the turtle can be swallowed or can strangulate body parts.

Disadvantage: None identified.

(2) Restrain turtle.

Advantage: Keep animal confined to reduce potential injury.

Disadvantage: None identified.

1 and 2 above can be reversed dependent upon circumstances.

(3) Remove hooks that are externally imbedded or visible in part or whole when viewed in the open mouth.

Advantage: Prevent further external injury and infection. It is more traumatic to the turtle to try to remove a hook that can't be viewed than it is to leave the hook in place.

Disadvantage: None identified.

(a) Prop mouth open with a suitable object which can be held in place, such as a broom handle or other wooden object. Metal objects should not be used.

Advantage: Able to view the hook with the least amount of trauma possible, and to provide protection to the person removing the hook. Prevents excessive trauma to the turtle's beak.

GUIDELINES FOR TREATMENT OF HOOKED/ENTANGLED SEA TURTLES BY FISHERMEN...continued

(b) Hooks that are not visible, and therefore cannot be removed, should have the line cut as close to the hook as possible.

Advantage: To prevent remaining line from being swallowed and/or strangulating body parts.

Disadvantage: None identified.

2. Release turtle as gently as possible in a direction away from the vessel with engine gear in neutral position.

Advantage: To prevent injury from propeller.

Disadvantage: None identified.

GUIDELINES FOR TREATMENT OF HOOKED/ENTANGLED SEA TURTLES BY OBSERVERS

1. Assess turtle's condition.

   a. If there is no visible movement:

      (1) Determine if dead or alive (use methods described earlier).

      (2) Remove hook/entangled line using hook extractor.

         (a) Prop mouth open with a suitable object which can be held in place such as a broom handle or other wooden object (metal objects should not be used). Grasp the hook with a plier-like tool.

         Advantage: To better visualize hook with the least amount of trauma possible, to provide protection to the person removing the hook, and to prevent beak trauma.

         Disadvantage: None identified.

         (b) Touch the eye and pinch the tail periodically up to 24 hours to see if there is a response.

      (3) Collect life history data.

      (4) Place in a shaded, protected area covered with a moist cloth with the head in a down position. Elevate hindquarter several inches, attempt resuscitation for comatose or assumed comatose turtles.

      (5) Check turtle periodically for up to 24 hours.

      (6) If the turtle is judged to be dead, after 24 hours, as per standard observer protocol, tag, and store it on ice or in a freezer.

   b. If turtle is determined dead:

      (1) Leave any entangled line or hook in place and cut line leaving about 2 feet remaining and tape it to the turtle.

      (2) Collect life history data as per standard observer protocol.

GUIDELINES FOR TREATMENT OF HOOKED/ENTANGLED SEA TURTLES BY OBSERVERS...continued

(3) Write collection identification information on tag, attach tag securely to turtle, and store turtle on ice or in a freezer.

c. Active turtles.

(1) Remove entangled line and hook from turtle if hook can be removed.

(2) Collect life history data.

(3) Release turtle as gently as possible in a direction away from the vessel with engine gear in neutral position.

CONCLUSIONS

The handling guidelines for retrieval and treatment recommended by the workshop participants constitute positive and practical actions for enhancing the survivability of turtles hooked or entangled in the Hawaii longline fishery. Using the best information available, the guidelines were formulated through interactive strategic planning by a panel of marine turtle specialists, at-sea observers, and veterinary professionals. While specifically designed for the Hawaii fishery, the recommended guidelines should be applicable to longlining elsewhere, both nationally and worldwide.

The next step in this mitigation process will be to transform the guidelines into an array of educational materials (brochures, videos, etc.), including appropriate language translations of Korean and Vietnamese, to properly inform and educate longline fishermen in Hawaii. This important avenue urgently needs to be pursued.

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Appendix B.--Fishermen's perspective of workshop recommendations.

Although one Hawaii longline fisherman and one fishing industry representative were able to take part in the first day background session of the workshop, none were able to participate in the discussions which led to the formulation of the proposed recommendations or guidelines. Therefore, following the workshop, NMFS met with four experienced swordfish longline fishermen and two industry representatives to discuss the recommendations from the workshop.

The fishermen made four major points:

1. Cooperation and concern: the fishermen expressed their willingness to cooperate with NMFS in increasing the survivability of turtles caught incidentally in the longline fishery. And they indicated that they shared NMFS's concern about the survival of turtles.

2. Support for retrieval guidelines: the fishermen indicated they generally supported the line and turtle retrieval recommendations, which they felt were consistent with good fishing practices anyway.

3. Questions on bringing turtles on board: the fishermen were very leery of bringing turtles of almost any size on board their vessels for three reasons: questions concerning the legality of so doing; questions concerning the potential trauma to the turtles involved in bringing them close enough to the side of the boat to board them; and questions concerning the safety of their crew in boarding the turtles and trying to treat them on board.

4. Concern about the direction of turtle-related regulations: the fishermen questioned why their fishery was singled out for regulation (in contrast to foreign and other domestic longline fisheries and in contrast to nearshore and on-shore small-boat troll fisheries), and what the actual status of turtle populations was, including incidental take.

There was also a general discussion of ways to avoid taking turtles. The general consensus seemed to be that taking turtles was a random event, rather than necessarily associated with any particular fishing location, season, or gear use.

Appendix C.--Selected Workshop Presentations.

OBSERVED SEA TURTLE INTERACTIONS - HAWAII LONGLINE FISHERY (FEBRUARY 27, 1994 - FEBRUARY 20, 1995)

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INTRODUCTION

The Fisheries Observer Branch develops and administers mandatory observer programs. Observers have been placed aboard U.S. tuna purse seine vessels since 1976 and aboard California gillnet vessels targeting swordfish and California halibut since 1990. These programs determined the incidental take of marine mammals under the authority of the Marine Mammal Protection Act.

The Hawaii-based longline targets swordfish and tunas and has been managed under a Fisheries Management Plan since 1987. As part of the plan, a voluntary observer program was fielded from July 1993 to December 1993. Training for mandatory observers began on February 7, 1994 for a three week period. The first two mandatory observers departed on longline fishing trips on February 27, 1994. From that point through February 20, 1995, 55 observed trips were completed.

The fishing effort of the Hawaii-based longline fleet was divided into four sampling strata (swordfish, tuna, mixed, and switcher categories) determined from the 1993 logbook data. This pre-trip stratification is the basis for the statistical distribution of observer coverage (DiNardo, 1993). Vessels that fished only for swordfish or tuna were classified in the swordfish and tuna strata, respectively. Vessels that changed from set to set to target either swordfish or tuna were considered mixed strata, while vessels that made some exclusively tuna trips, plus some exclusively swordfish trips, were categorized as switcher vessels.

Since March 6, 1994, shoreside personnel have conducted daily dock rounds in Honolulu, to determine which longline vessels are in port. Dockside information is used to identify longline vessels that leave port without providing the observer program the required 72-hour departure notice. Dock rounds are also used to provide a rough estimate of fishing effort, assuming that vessels are fishing when they are absent from the harbor. With this assumption, mandatory observers have covered about 5.3% of the fleet's activity (55 observed trips of 1,031 vessel departures).

The following definitions are used to define the status of protected species interacting with longline gear:

Alive = an animal removed from the fishing gear that can swim or fly normally. The animal is likely to have minor cuts and abrasions from being entangled.

Injured = an animal released from the fishing gear with obvious physical injury or with gear attached. An injured animal may lie at the surface, breathing irregularly or swim or fly in abnormal manner. If an animal is impaled on a hook, it is injured.

Dead = an animal removed from the fishing gear in a postmortem state. Animals will show a lack of muscular activity and may float passively at or below the water's surface.

Unknown = an animal lost, released, or escaped from the fishing gear whose condition was not determined.

Sea turtle tagging kits were first deployed in August 1994, and 14 turtles have been tagged to date. Sea turtle biopsy training was completed on January 13, 1995. Since that time, one turtle has been biopsied.

DISCUSSION

Table 1 shows 570 sets and 599,700 hooks observed resulting in 38 turtle encounters. Thirty-five percent of the observed trips had turtle encounters. For the 55 observed trips, the catch rate of turtles per 1,000 hooks is 0.063. This same rate for the voluntary program is 0.061 turtles (NMFS, 1994).

TABLE 1

SEA TURTLE ENCOUNTERS - OBSERVED RESULTS
Hawaii-Based Longline
Mandatory Observer Program
February 27, 1994 through February 20, 1995

Observed Trips ---------->	55
Trips with Turtles ----->	19
Trips without Turtles -->	36
Turtle Encounters ------>	38
Total Sets ------------->	570
Total Hooks Set -------->	599,700
Turtles per 1,000 Hooks =	0.063

Table 2 summarizes sea turtle interactions recorded by mandatory observers. Sea turtles are sorted by species, encounter type, hook location, and condition. Hooks are considered ingested if it is past the mouth cavity and in the esophagus. A hooked turtle is recorded as injured unless it is dead. If dead, it is recorded only as dead.

Observer data suggest that leatherback turtles are less likely to go after bait since most are hooked in the flipper or entangled in the gear. Diet preference could be an explanation since pelagic leatherbacks are primarily water-column feeders preferring jellyfish and other coelenterates. On the other hand, it appears that loggerhead turtles are actively pursuing baited hooks. Eighteen of the 20 loggerhead turtles were hooked in the head or beak or ingested the hook. It has been reported that pelagic loggerhead turtles eat coelenterates and cephalopod mollusks in the pelagic stage (van Nierop and den Hartog, 1984). The olive ridley and green/black turtles that interacted with longline gear also were hooked in the head or beak or ingested the hook.

Table 3 identifies the operator's stated fish target compared to species actually caught. These data show that although an operator is targeting swordfish on some trips, more tuna may be caught than any other species. This table also shows the number of turtles taken compared to the number of hooks set. From these data, it appears that the incidental sea turtle catch rate is higher on swordfish trips than on tuna trips. This is expressed in the ratio of turtle encounters per 1,000 hooks.

Figure 1 lists sea turtle encounters by fishery, as stated by the operator. Seventy-nine percent of the sea turtle encounters can be attributed to the swordfish fishery while 8% is from mixed trips. Assuming the turtles encountered on a mixed trip were taken during swordfish sets, then nearly 87% of the sea turtles would be associated with the swordfish longline fishery. Only 13% are related to the tuna longline fishery.

Typically, vessels targeting tuna set and retrieve fishing gear during the day and do not use lightsticks. However, longline operators who target both swordfish and tuna do not modify or add equipment to the vessel except lightsticks on swordfish sets.

Vessels targeting swordfish use large squid. Vessels targeting tuna use saury. However, swordfish vessels targeting tuna will still use large squid instead of saury. Another difference is that some tuna vessels are equipped with a shooter that allows the mainline to let out faster than the vessel is traveling. This causes additional sag in the mainline allowing the gear to fish deeper. Swordfish vessels that are targeting tuna but have no shooter cannot achieve the additional depth. These differences make analysis of turtle encounters by fishery more difficult.

Table 2

SEA TURTLE ENCOUNTERS - OBSERVED RESULTS
Hawaii-based longline

February 27, 1994 through February 20, 1995

Count	Turtle Species	Encounter Location	Hook	Condition
1	Leatherback	Hooked	Ingested	Injured
2	Leatherback	Hooked	Head/Beak	Injured
3	Leatherback	Hooked	Flipper	Injured
4	Leatherback	Hooked	Flipper	Injured
5	Leatherback	Hooked	Flipper	Injured
6	Leatherback	Hooked	Unknown	Injured
7	Leatherback	Entangled	n/a	Alive
8	Leatherback	Entangled	n/a	Alive
9	Leatherback	Unknown	Unknown	Unknown
10	Loggerhead	Hooked	Ingested	Injured
11	Loggerhead	Hooked	Ingested	Injured
12	Loggerhead	Hooked	Ingested	Injured
13	Loggerhead	Hooked	Ingested	Injured
14	Loggerhead	Hooked	Ingested	Injured
15	Loggerhead	Hooked	Ingested	Injured
16	Loggerhead	Hooked	Ingested	Injured
17	Loggerhead	Hooked	Ingested	Injured
18	Loggerhead	Hooked	Ingested	Injured
19	Loggerhead	Hooked	Ingested	Injured
20	Loggerhead	Hooked	Head/Beak	Injured
21	Loggerhead	Hooked	Head/Beak	Injured
22	Loggerhead	Hooked	Head/Beak	Injured
23	Loggerhead	Hooked	Head/Beak	Injured
24	Loggerhead	Hooked	Head/Beak	Injured
25	Loggerhead	Hooked	Head/Beak	Injured
26	Loggerhead	Hooked	Head/Beak	Injured
27	Loggerhead	Hooked	Head/Beak	Injured
28	Loggerhead	Entangled	n/a	Alive
29	Loggerhead	Entangled	n/a	Alive
30	Olive Ridley	Hooked	Ingested	Injured
31	Olive Ridley	Hooked	Head/Beak	Injured
32	Olive Ridley	Hooked	Head/Beak	Injured
33	Olive Ridley	Hooked	Head/Beak	Injured
34	Green/Black	Hooked	Head/Beak	Injured
35	Green/Black	Hooked	Head/Beak	Injured
36	Unid. Hardshell	Hooked	Ingested	Injured
37	Unid. Hardshell	Hooked	Unknown	Injured
38	Unid. Hardshell	Unknown	Unknown	Unknown

Table 3

OBSERVED RESULTS - 55 COMPLETED TRIPS
Hawaii Longline Fishery
February 27, 1994 through February 20, 1995

Trip Count	Operator's Target	No. Fish Caught Swordfish	Tuna	Turtles Caught	Total Hooks Set	Turtles per 1,000 Hooks
1	Swordfish	185	273	9	8,585	1.048
2	Swordfish	335	206	4	18,530	0.216
3	Swordfish	145	479	4	7,031	0.569
4	Mixed	254	95	3	15,558	0.193
5	Swordfish	125	507	2	9,085	0.220
6	Swordfish	75	28	2	8,555	0.234
7	Tuna	109	229	2	7,091	0.282
8	Swordfish	242	34	1	24,992	0.040
9	Tuna	1	142	1	14,537	0.069
10	Swordfish	167	5	1	11,500	0.087
11	Swordfish	129	1	1	11,048	0.091
12	Swordfish	139	65	1	8,190	0.122
13	Swordfish	150	24	1	7,900	0.127
14	Swordfish	48	22	1	7,610	0.131
15	Swordfish	54	6	1	7,328	0.136
16	Tuna	50	14	1	7,075	0.141
17	Swordfish	69	133	1	4,350	0.230
18	Swordfish	19	1	1	3,564	0.281
19	Tuna	5	5	1	2,400	0.417
20	Tuna	0	388	0	22,947	0.000
21	Tuna	0	191	0	21,613	0.000
22	Tuna	1	130	0	21,460	0.000
23	Tuna	1	421	0	21,018	0.000
24	Swordfish	214	56	0	18,160	0.000
25	Tuna	8	173	0	17,620	0.000
26	Tuna	1	65	0	16,750	0.000
27	Tuna	12	233	0	15,926	0.000
28	Tuna	0	26	0	15,880	0.000
29	Tuna	1	124	0	14,994	0.000
30	Tuna	4	331	0	13,303	0.000
31	Tuna	249	83	0	12,933	0.000
32	Tuna	68	80	0	12,822	0.000
33	Tuna	2	29	0	12,800	0.000
34	Tuna	3	233	0	12,100	0.000
35	Tuna	1	0	0	11,843	0.000
36	Tuna	14	83	0	11,355	0.000
37	Tuna	1	6	0	11,035	0.000
38	Mixed	6	16	0	10,766	0.000
39	Tuna	0	43	0	10,599	0.000
40	Tuna	6	52	0	10,519	0.000
41	Tuna	0	31	0	8,900	0.000
42	Tuna	0	287	0	8,736	0.000
43	Swordfish	158	316	0	8,720	0.000
44	Swordfish	105	11	0	8,650	0.000
45	Swordfish	103	7	0	8,530	0.000
46	Tuna	0	445	0	8,100	0.000
47	Mixed	22	22	0	8,007	0.000
48	Tuna	4	67	0	7,265	0.000
49	Tuna	22	68	0	6,535	0.000
50	Swordfish	17	21	0	6,261	0.000
51	Tuna	13	33	0	5,042	0.000
52	Swordfish	23	4	0	4,748	0.000
53	Tuna	2	156	0	4,653	0.000
54	Tuna	11	3	0	3,214	0.000
55	Swordfish	4	0	0	967	0.000
Totals		3,377	6,503	38	599,700	0.063

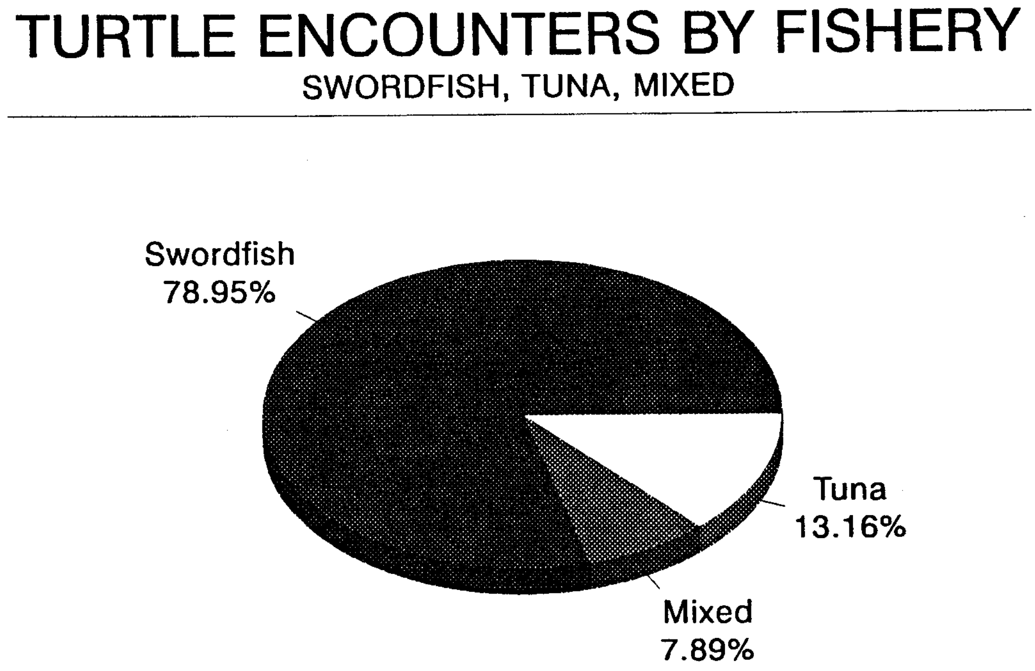

FIGURE 1. Sea turtle by fishery. The fishery type was determined by what the operator stated he was targeting.

Figure 2 shows that all turtles were encountered during sets made at night except one. As expected, most of the turtle encounters occurred during night sets since vessels targeting swordfish set their gear in the evening. However, that doesn't account for the high percentage taken at night. The depth of the hooks may be another factor related to turtle involvement. Table 4 indicates the target depths stated by the operator when asked by the observer, float line lengths, dropper line lengths and the combined float and dropper lengths for each sea turtle encounter. Unless a vessel uses a shooter, the depth of the hooks should not be much deeper than the summation of the dropper and float lines. Figure 3 shows the summation of dropper and float line lengths versus sea turtle encounters. Assuming vessels did not use a shooter, most of the sea turtle interactions occurred between 12.6 meters and 30 meters (41 feet to 98 feet).

Table 4 also summarizes light stick colors used, set times, bait type, hook type and proximately to a float for each sea turtle encounter. It appears that there may be a correlation between lightstick proximity and turtle encounters. However, no

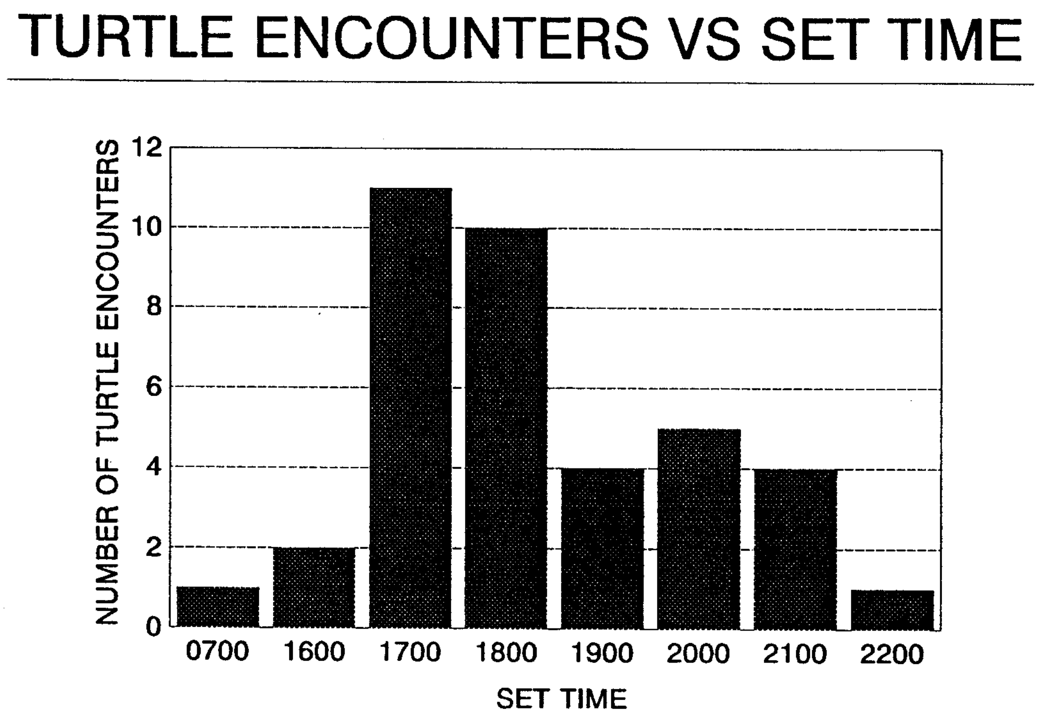

FIGURE 2. Sea Turtle encounters versus set time using 24 hour clock.

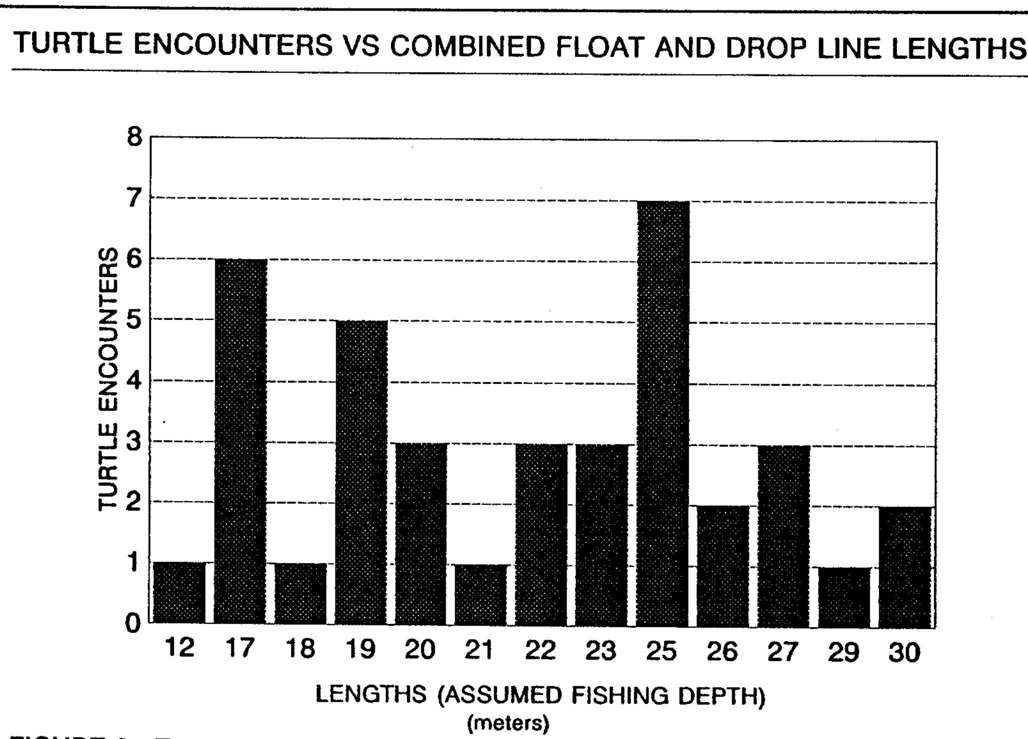

FIGURE 3. Turtle encounters versus combined float line and drop line lengths. Lengths are rounded to whole numbers and expressed in meters.

SEA TURTLE ENCOUNTERS - OBSERVED RESULTS
Hawaii-based longline

February 27, 1994 through February 20, 1995
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Target Depth	Float Line Length	Drop Line Length	Sum of Drop Ln. Float Ln	Proximity To Float/ Light Stick	Color Light Stick	Time Set Began	Date	Bait Type	Hook Type
?	9.0	16	25.0	0 / 2	8	2145	3-3	1	4
?	9.0	16	25.0	0 / 2	6	1925	3-5	1	4
13	3.6	9	12.6	1 / 2	2	2258	3-2	1	4
20	5.0	15	20.0	0 / ?	4	1950	3-15	1	2
20	5.0	15	20.0	1 / ?	6	2000	3-17	1	2
25	10.0	15	25.0	1 / 0	4	2009	3-20	1	2
20	6.6	13	19.6	2 / 1	?	2000	3-20	1	2
20	6.6	13	19.6	0 / 1	?	2030	3-25	1	2
20	6.6	13	19.6	0 / 1	?	1950	3-27	1	2
20	6.6	13	19.6	0 / 1	?	2015	3-30	1	2
?	4.5	18	22.5	0 / 0	2	1725	4-2	1	4
19	4.5	15	29.5	? / 0	2	1814	4-23	1	4
20	9.2	16	27.2	0 / 0	4	2100	5-7	1	2
22	5.0	17	22.0	2 / 1	2	1614	4-13	1	3
31	7.2	14	21.2	0 / ?	?	1700	5-12	1	2
15	4.7	18	22.7	0 / ?	?	1710	5-20	1	2
33	8.3	12	20.3	0 / 0	4	2100	7-23	1	2
15	4.6	14	18.6	1 / 2	2	1740	6-11	1	4
22	7.7	12	19.7	0 / 0	6	2140	10-18	2	4
5	5.5	21	26.5	0 / ?	?	1740	10-15	2	2
5	5.5	21	26.5	0 / ?	?	1800	10-17	2	2
27	3.5	22	25.5	0 / 0	6	1820	10-19	1	2
27	3.5	22	25.5	0 / 1	?	1820	10-19	1	2
27	3.5	22	25.5	0 / 0	2	1820	10-20	1	2
27	3.5	22	25.5	0 / 0	4	1820	10-21	1	2
15	6.3	21	27.3	1 / 1	6	1651	11-16	1	2
15	6.3	21	27.3	1 / 2	6	1700	11-18	1	2
27	12.0	11	23.0	0 / 0	6	1753	1-11	1	4
27	12.0	11	23.0	0 / 1	6	1747	1-14	1	4
27	6.0	11	17.0	1 / 0	6	1850	1-15	1	4
27	6.0	11	17.0	0 / 1	2	1850	1-15	1	4
27	6.0	11	17.0	0 / 0	6	1755	1-16	1	4
27	6.0	11	17.0	0 / 0	6	1755	1-16	1	4
27	6.0	11	17.0	0 / 0	2	1800	1-17	1	4
27	6.0	11	17.0	0 / 0	2	1800	1-17	1	4
27	12.0	11	23.0	1 / 0	6	1913	1-18	1	4
200	18.0	12	30.0	0 / ?	?	0758	1-31	3	1
30	8.0	22	30.0	0 / 0	2	1730	2-13	2	2

Proximity Codes

To Float Line
- 0 = Next Line
- 1 = 1 away
- 2 = 2 away

To Light Stick
- 0 = On Drop Ln.
- 1 = 1 away
- 2 = 2 away

Light Stick Color
- 2 = Green
- 4 = Pink
- 6 = Yellow
- 8 = Other

Hook Type
- 1 = Tuna
- 2 = Mustad
- 3 = Offset
- 4 = Other

Bait Type
- 1 = Lg. Squid
- 2 = Sm. Squid
- 3 = Saury

Table 4. Observed sea turtle encounters compared to float line and dropper line lengths, proximity to floats and lightsticks, lightstick colors, time and date of set, bait type and hook type used.

trends were noticeable in relation to light stick color. Figure 4 depicts turtle proximity to light sticks and Figure 5 shows light stick color versus sea turtle encounters. There are insufficient data to determine whether different hook types are more likely to cause sea turtle interactions. Yet, 97 percent of the turtles taken were on hooks baited with either large or small squid. This indicates that bait type may be important. Incidentally, squid and pomfret are the most common prey found in the stomachs of swordfish caught in Hawaii's longline fishery.

Seventy-one percent of turtle encounters were on a hook adjacent to a float line attachment as shown in Figure 6. This may indicate that shallower hooks are more likely to have turtle encounters since hooks further away from floats should fish deeper because of mainline sag.

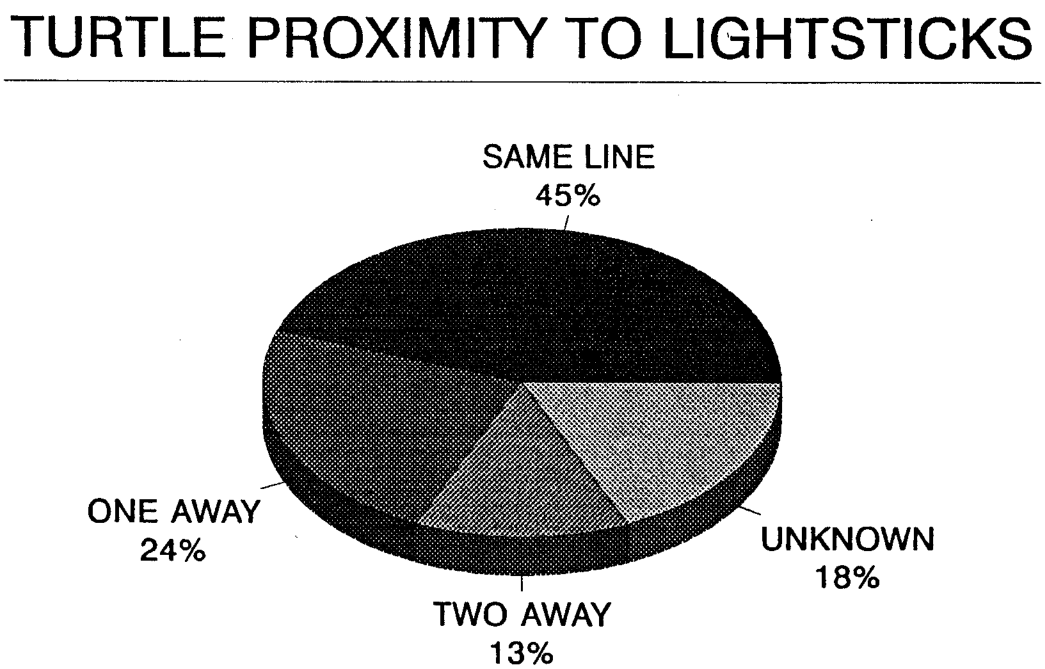

FIGURE 4. Turtle encounters compared to lightstick proximity. Lightsticks are either on the same line as the hook, one line away, two away, or unknown.

TURTLE ENCOUNTERS VS LIGHTSTICK COLORS

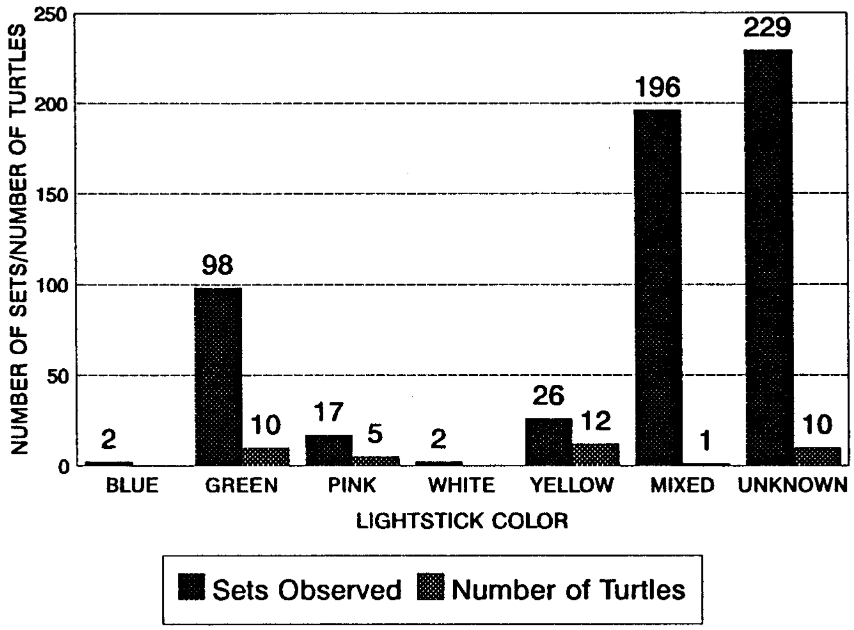

FIGURE 5. Turtle encounters compared to the number of sets and color of lightsticks used.

TURTLE ENCOUNTERS PROXIMATELY TO FLOAT

ONE AWAY, TWO AWAY, ADJACENT, UNKNOWN

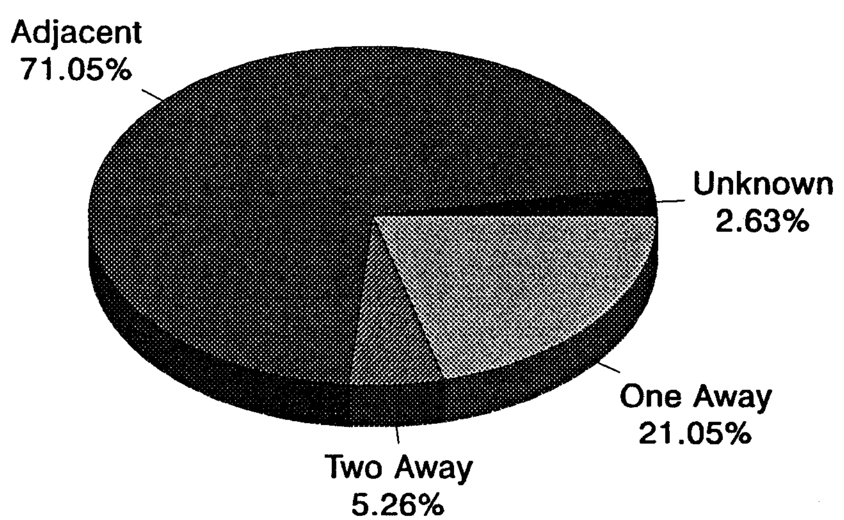

FIGURE 6. Observed sea turtle encounters relative to the hook proximity to the float line.

CONCLUSION

The best sea turtle data available for the Hawaii-based longline are being collected by NMFS mandatory observers. It is not possible to determine seasonal or annual trends with only one year of collected data at 5% observed coverage. These data are important to help managers determine the impact of the longline fishery on different sea turtle populations. The sea turtle tagging and biopsy information will provide valuable insight into the population dynamics of Pacific Ocean sea turtle populations.

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Appendix C.--Continued.

VETERINARY EXPERIENCES WITH HOOKED SEA TURTLES

Edited transcript of verbal presentation
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As one of several wildlife veterinarians at the University of Florida, we work out of a teaching hospital which is part of the College of Veterinary Medicine. Our service evaluates free-ranging wildlife and those in captivity. Around 18 years ago, I started working with sea turtles, both free-ranging and those in farming operations. Much of the work has been infectious disease studies. We also see a wide variety of injured sea turtles sent to us from rehabilitation facilities in the state of Florida. And these turtles are often in critical condition. We serve primarily as a referral center for difficult cases. And our mortality rate also reflects the fact that we often receive animals that are in very critical condition.

So our experiences with hooked sea turtles, for the most part, have been animals that have significant problems. However, we have also worked on some sea turtles which have been superficially or minimally damaged by hooking. And so what I'd like to do is to show you a few of the cases/examples that we have seen.

But before I do so, I think it's important to briefly discuss their anatomy so that you have a sense of the gross structure of sea turtles. I will superficially go over their anatomy, with primary attention to the gastro-intestinal (GI) tract, because that's the major site of hooking, although there's hooking in flippers and in the head and around the beak and so on. It's the internal hooking that is more problematical and is going to take much more work.

This whole area of trauma caused by hooking, and the effects upon turtles, is a very complicated area, which we can talk about at length. And I think over the next 2-1/2 days we'll have the opportunity to address some of these areas in more detail. But, there's a point I want to present that there is a tendency for people to see reptiles (including sea turtles) as simple, in a lot of ways, and because of that they think they can sustain more significant damage and survive compared to a mammal. The other end of the spectrum are birds, which are seen as more fragile. This is in regard to being able to manipulate them and do things with them and surgically work on them and the kind of damage they can sustain. Reptiles are seen often as, for some bizarre reason

I'm not sure, as being able to sustain a lot more damage and still survive.

And I will say that the hard thing with my experience as a clinician, and also as a person who works on disease problems with these animals, is that they're very hard to assess. The level of damage. The overall condition of sea turtles are very difficult to assess. And that's after working on these animals for 18 years. I've seen animals that when I've necropsied them, working them up pathologically, you wonder how they lived as long as they did when 3/4 of their liver necrosed or part of their G.I. tract is necrotic. As an example, with a sea turtle, we received a hawksbill about 5 or 6 months ago that was caught off the Keys in South Florida. It was brought into another facility and was held for a couple of months and then after 2 months or so of not doing well and just not eating, and looking poorly (it was in critical condition) it was sent to us at the University of Florida. And many similar turtles are flown in by Air Florida Freight, as a free charge or a minimal charge. And this was a animal that was in very poor condition and we assessed it which included a complete diagnostic work up and we knew radiographically (by x-rays) that there was something wrong in its G.I. tract. And radiography indicated that the intestine was not normal and we were prepared to go in and do surgery on it, but it died. The next morning when it was necropsied, it turned out that it had a volvulus of its G.I. tract (that part of its intestine had wrapped around on itself). Approximately 2 feet of the G.I. tract of this turtle was necrotic. One piece of plastic was found in the vicinity of the volvulus. The plastic probably acted as nidus for this whole event.

Here's an animal going on for 2 months with a chronic medical problem. And it eventually died. And we've seen similar medical problems with different reptiles including sea turtles. And in other situations there are animals that die, and you necropsy them and can't determine the cause of death. So there's a whole range of things that are going on in these animals. Some are very easy to diagnose and determine the health status, and others are very good at masking their problem. They're different from mammals in that they're difficult animals to assess.

So when we look at hooking as an event, what is the impact on these animals? How do we assess the damage? The thing I will try to sell here is that I think it's a very significant event when you have a hook going through an organ, even if its through a flipper, but particularly in the G.I. tract. The simple thing is to cut it off and throw the animal back at sea, and then it's anyone's guess what the outcome will be. We don't have good studies to conclusively document what kind of mortality we are facing with animals that have been hooked. If it appears to be healthy and moves around you then return it to the sea. The odds are you'll never catch it again.

I think the Greenpeace study[1] (in the Mediterranean) is a good study to look at. At least that's the only study that I know that was presented at our meeting a year and a half ago. A percentage of turtles hooked in the Spanish longline fishery were brought into a rehabilitation facility and about one-third eventually died.

It's hard to assess where these animals are at. It's easy to be deceived by their behavior when you're releasing them. Hopefully over the next 2-1/2 days we can come up with some recommendations on how to improve the survivability of these animals after they're released. We can talk about "pie in the sky" surgery which is surgery under the best of conditions versus reality, which is how are you going to medically treat these animals in the field.

We work under the best of conditions, I believe, at our teaching hospital and also I have worked a lot in the field. So some of the things I'll talk about are under the best of conditions. Then we'll have to look at what can be done under the worst of conditions. That's what we're probably talking about, trying to do something under the worst of conditions.

Captivity is not always the best place for an ill wild animal. The behavior of certain species is such that captivity imposes a significant amount of stress to these animals. I'm not an artist by any means. I was trying to sketch out some things here with a turtle. We can just quickly look at the head. This is the stylized head of the sea turtle. His tongue sits up here as a fairly thick structure that doesn't move too much. Then the glottis comes off the back end of the tongue and runs into the trachea and comes all the way down into the animal and bifurcates at what we call the thoracic inlet. One lung is a little larger than the other. The lung has a scalloped appearance like that and it goes all the way down to about the level of the kidneys. The esophagus is running here on either side. Then it goes through here and it makes an s-shaped bend like this. Next, the G.I. tract dilates into the stomach and continues as the stomach. And so we're looking at, this is left and this is right, it comes across here and it narrows down and gets to the pylorus and the duodenum and then it starts looping on itself.

The esophagus is lined by papillae which makes it difficult to visualize hooks. The further the hook moves caudally in the esophagus, the more difficult it is to see where the hook is. And, of course, when it gets beyond this bend it's impossible.

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[1] Aguilar, R., J. Mas, and X. Pastor. 1991. Impact of Spanish swordfish longline fisheries on the loggerhead turtle, *Caretta caretta*, population in the western Mediterranean. Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, NMFS-SEFSC-361, p. 1-6.

And this bend here, this s-shaped bend makes it very difficult to try to get into a stomach of the turtle, even when you have a flexible scope. So it makes this bend here and comes across the left bronchus and comes around and then you have the stomach and it comes down over here.

We have seen hooks on turtles all the way down. And we've had hooks go all the way down to the colon. And some of them will be passing free at a certain point. But they still may get lodged, followed by tissue necrosis, and then the hook starts passing down and will probably just pass out in the feces as described for some turtles in the Greenpeace study. It may have turned out that the hook was caught higher up and then the tissue just sloughed and worked out and then it's just passing along as a foreign body. It is always possible, with contractions, that the hook could get set again further down. We've had some where the hook has been set down in the colon, intestine, so that can happen.

This tissue, the esophagus, in a normal animal, is set fairly firmly attached to the underlying tissue by some connective tissue. And a real problem when this animal gets hooked is that it's being traumatized and torn from the subadjacent tissues. There's a lot of trauma that can take place just from the pulling of the organs of the animal on the hook, flapping around in the water or especially when it's being lifted onto a boat by the line itself. As soon as you start putting force on this animal, on that line, you just start to rip all these tissues free. Plus you're setting the hook deeper in the tissues.

Once the hook is set and pierces the organ then it is possible to get an infection. In speaking to people at Sea World in Florida, and some other people in the state, they've had hooked sea turtles with infections developing from the point of penetration into coelomic structures. The result is a large infection in the area of the hook, which can result in the death of the animal.

So hooking can result in further problems beyond the initial trauma to the animal. The further down you go the more difficult it is to get the hook out. And so one of the points of discussion is - when do you try to remove the hook, and when do you just leave it there and cut it off? I believe that some device can be fashioned. There are ways to try to control this flopping turtle on the boat. We can discuss simple things such as putting the turtle in a bag and containing its whole body with velcro straps. Something that can be done quickly where the animal is put in something, wrapped over, at least you control the limbs. And then fashioning a device for the head that would open up the mouth and somewhat completely cover the head so that you're not getting bitten. Because, as we all know, it's very easy to lose a finger working around the head of a large turtle.

Without a doubt, especially in a boat at sea, I can imagine what it's like when you're trying to get things done quickly. And when you're trying to do things quickly that's the time for disaster. I almost had my fingers taken off by loggerheads in our teaching hospital working around their head and mouth while they're moving and trying to open up their mouth. But, I think, getting their mouth open and getting a device that would do it without traumatizing the head and the beak, which can be traumatized when you start putting brooms or other things in there and then they clamp down on it. You can take divots out of their beak. So you want to look at using something that is not going to cause trauma and that's safe, such as something made out of rubber. We use rubber mouth gags on many of these animals to open their mouths. But I think a device can be fashioned that would sit over their head and allow you to get their mouth open and protect someone from being bitten.

Okay so that is background. I'll just show you a few of the slides. Several different types. This was a ridley that came in quite a few years ago. It was caught by a sport fisherman, and it came in from Marineland (Florida). At this point, most of our turtles that we get in, when we work on them, are anesthetized. It's the easiest thing to do in our setting, but we also have the luxury of sitting around and letting this animal recover for 5 hours with a student who can sit with it. When you anesthetize these turtles the real art is trying to keep your recovery to a minimum. Getting them anesthetized is no major problem. We can get it done fairly efficiently. We've done a lot of turtles over the years. We have different approaches for different turtles depending on how big the turtle is and how much it's fighting. We can use injectable agents, chemicals that can be injected into them, which will semi-sedate them. Invariably we intubate them and put them on a gas anesthesia machine. Then we can take them down with a gas agent and then keeping them at the appropriate plane is the art. This is at a plane in which the animal is not flopping around and you can do what you need to do. If it's surgery, they're under a surgical plane of anesthesia.

Recovery may take several hours and it is not generally until the next day that we put them back in their tank. So if we're doing the procedure and we anesthetize them during this period of recovery we tend to have them in little kiddie swimming pools. They'll sit in there in a very shallow amount of water and what you will see, as they recover, is that they'll start flopping around and they appear to be moving fairly well and then they'll collapse. Then they'll go quiet for an hour. And that's when they're building up their energy again or the gas is recycling. But they very characteristically will start flapping around, use up a lot of energy, and then they'll just collapse.

And so to see an animal active for a couple of minutes doesn't necessarily mean that it's going to be fine when you put it back in the water. And one of the things, of course, of assessing turtles when you bring them up on a boat is that while they may flop around for awhile, they still may not have enough energy to swim properly. But if you are releasing an animal that has run out of energy, the question is - is he really back to normal, or is he close to normal, or is he at a state where he's used up most of its energy? A turtle which has expended most of its energy while being hooked and then immediately returned to the sea will probably die.

Telemetry would be extremely useful to look at the outcome of hooked turtles. Following some of these animals to see how they do will be an interesting study.

So this slide represents a ridley sea turtle on gas anesthesia with a hook in the esophagus. Different types of forceps can be used for pulling out and removing these hooks. I think that one could devise a forcep that would work well for extracting hooks within the esophagus. One could be devised that would run down a line and then at least the hook could be either cut as close as possible to the esophagus, or if it's superficially situated, one might be able to dislodge it. But once they're set you're not going to be pulling them out without a lot of trauma. So my question is, is it beneficial to try to cut as much of that out as possible?

I think a device can be fashioned that at least through the straight part of the esophagus can be used for cutting the hook, with the line being used for following it down to its insertion. That could be done, just fashioning something. Joe (Flanagan) will probably talk about what he uses for pulling hooks out of the upper G.I. tract on turtles he is seeing.

This is a loggerhead from the Keys and this is one that was found dead and was photographed by, this I'm not sure of, it may be from Pat Wells, or someone else. I don't know if there are statistics at all on the number of stranded turtles in Florida that have been found with hooks on them.

Next slide. This is the esophagus for those of you who haven't seen the esophagus on a sea turtle. Sea turtles have a very unusual esophagus. When you see it, it's different then the esophagus of any other vertebrate. The esophagus is made up of all these papillae that are keratinized. There is a lot of keratin and it goes all the way down to the stomach. They're different thoughts as to why these animals have evolved these papillae and what they do. But what it also does is make it difficult to see hooks when you're going down with a flexible scope just to see where the hook is set.

Here's a hook coming down. This is a necropsy case and I don't know if any other lesions were seen. But here's the hook coming down and it's imbedded into the wall of the esophagus. And in some of these situations, in trying to look for a hook in a turtle with a scope, the esophagus folds on itself. It's just not easy to see where that darn hook is even when you have a scope and are looking down there.

Next slide. This is one of a loggerhead that was sent up for evaluation and we have this animal anesthetized. This is what we use now. But again they will chip off their beak trying to get their mouth open and by keeping it open. This is one that's been anesthetized and it's being scoped. And so we have these flexible scopes that allow us to go down into the stomach if we can negotiate that bend and really visualize the upper and lower G.I. tract of these animals.

Another thing that we use routinely on these animals, in terms of monitoring them, is this Doppler. The cost is approximately $300. It has a little transducer on the end and you can just put it right over the carotid at the base of the limb here, and you hold it on. You can listen to pulse rate and heart rate. For the cost, it is one of the best monitoring instrument that we use in our service. It can be used on so many different animals for assessing where these animals are anesthetically. And, also, if you're trying to determine whether a turtle is dead or alive and whether it has a heartbeat. Because sometimes it is difficult to determine if a turtle is dead or alive.

A ridley sea turtle was sent in and we did surgery and supposedly it died. It was put in the cooler at night, and I came in the next morning and brought it out and it was still alive. We found that this animal was not responding in any fashion. I thought it just had died. It had a very faint heart beat and so this is something we routinely use for monitoring. But this is under the best of conditions.

Next slide. This is Dr. Beatrice Lopez who is a veterinarian who graduated from our school and is practicing in Marathon, Florida. She does veterinary work on injured sea turtles for the Sea Turtle Hospital in Marathon. This loggerhead had two hooks. It had one hook up in its esophagus, which was removed, and radiographically another hook down here in the colon which was removed. And this is the surgical site, I'll show some better slides, for removing hooks in the lower part of the G.I. tract. And so this is the skin adjacent to the hind flipper.

Next slide. This a ridley sea turtle we received last year from the Panhandle of Florida, and it was hooked. The hook was down in its colon actually.

Next slide. We can see this radiograph of the hook and its down in the colon right next to a hind leg. And this would be, actually this is an ideal location for surgery for being able to pull a hook out through the skin by the hind leg. Very simple and straightforward. One of the most difficult places is in the s-shaped bend (of the esophagus). That would be the most difficult place to get at surgically. Even as a surgeon going in, under the best of conditions, this area in here is extremely difficult to get at through any approach in these animals.

Next slide. This will show you the surgical site adjacent to the hind flipper. Here we're just incising the skin.

Next slide. We're pulling out the G.I. tract and this actually has already been sutured. The hook was stuck in the wall, and the hook was just pushed completely through the wall and just pulled out through a little hole through the wall and the intestine is normal in appearance. There wasn't any pathology associated with it.

Next slide. We just pulled it out and sutured up the animal. It recovered without any problems and it went to Sea World of Florida, and was subsequently released. That was pretty straightforward.

I think that's the last slide I have. The majority of the cases that we have seen are in the upper G.I. tract. I don't know what percentage of those that you have seen in the Pacific fishery one beyond the s-shaped bend. How far down they are is anyone's guess. How far down the hook is located will affect what you're going to be able to do. As far as trying to get the hook out or reduce it in some way.

There are other things to discuss just very briefly and will come up in terms of recommendations. As far as trying to develop how to assess the condition of these animals, it will be important to be able to categorize these animals that are being hooked. The condition that they are in and how they should be treated beyond trying to remove the hook. Whether it is worthwhile or practical to use any types of treatments out at sea. And whether they'll be people there who'll be able to do this effectively. Whatever is recommended should ultimately be presented through a workshop for the people in the fishery who are going to be doing this. Somehow this information has to be disseminated and put in a form that the people out there who are involved with these animals will understand what is going on, and what needs to be done. That's something to discuss further on.

I've had workshops like this before where you can come up with great ideas, but you can't translate it down to a level in which they can be implemented. The most effective way to do it is by some type of demonstration workshop. We've done this, for example, in working with desert tortoises out in the Mojave desert for many years. We've developed recommendations on how these desert tortoises should be manipulated and samples collected. A videotape was also put together.

Then that can be used and the methods and the approach can be standardized pretty well, as well as possible. You never know. Some individuals will really get into it and want to do a good job and others will just want to get done, and so on. But you need to be thinking along that line if there is going to be more than just a document resulting from this workshop.

I think the point again is that hooking is a significant problem to a turtle. Just think about what it will be like for you to have a hook of that size in your esophagus. And I'll tell you that it's probably not that much different for these animals. Hooking is not something that sea turtles have mechanisms to deal with. Now getting your flipper chewed off by a shark is, based from our experience with injured sea turtles that have been bitten by sharks and have big divots of their shell taken out or even hit by a boat. It is amazing how well they can repair at times from trauma, external trauma lesions, but some of these other things internally, no. There was another good case that I was informed of and was sent slides of a fish bone which had migrated through the esophagus of a loggerhead into the pericardium of the heart and it had pericarditis, very similar to what we see in cattle with hardware disease.[2] And it had a massive infection. So they die from these types of injuries probably in the field and a hook through the esophagus plus the turtle being underwater for awhile and being pulled is not really good for them. When pulled out of the water they may appear to have a lot of energy initially, making them very difficult to work with on the deck. Still you have to consider that the animal has been stressed and has a very good possibility of becoming infected and will die from the injury.

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[2] Information on the removal of fishhooks from dogs and cats can be found in the following recent publication: Michels, G. M., Brent D. Jones, B. T. Huss, and C. Wagner-Mann. 1995. Endoscopic and surgical retrieval of fishhooks from the stomach and esophagus in dogs and cats: 75 cases (1977-1993). J. Am. Vet. Med. Assoc. 207(9):1194-1197.

Appendix D.--Nominal Group Technique[3]

There are several approaches used in the development of detailed programs for complex problems and issues, such as a multi-disciplinary, multi-year research plan or a regulatory regime which will affect an entire community. Most of these approaches involve types of planning which include a wide variety of participants in the planning process. But there is considerable diversity in these planning processes, from the expert-based "comprehensive" technical plan to "bottom up" strategic planning which sees itself as an on-going process (Benveniste, 1989; Peters, 1988). This appendix introduces the interactive approach to strategic planning developed at the Southwest Fisheries Science Center, particularly as applied at the Honolulu Laboratory.

The reason we plan is to change a contemporary course of action (or inaction). Planning, if it matters, is political because it attempts to change what we and others will be able to do in the future. Because it is political and not just a technical exercise, attention must be paid to the various *roles* played during the planning process (Benveniste, 1989). To summarize briefly, there are *the decision-makers, the stakeholders, the planners, and the planning participants*. The *decision-makers* are those ultimately responsible for deciding whether the plan will be implemented. Commonly decision-makers include chief executive officers of the corporations, agency, departmental, and organizational directors, and political leaders. The *stakeholders* are those that will be vitally affected by the plan. Commonly stakeholders are consumers and clients, as well as the employees and organizational members. The *planners* may be either intramural or external staff experienced in planning methodologies, and in many cases are viewed as *policy analysts* within their organizations. In interactive planning methodologies, these usually include people acting as *facilitators* or *mediators*. Finally, the *participants* are those directly involved in the planning process. In the interaction strategic planning methodology, they usually involve a combination of key external and internal stakeholders.

Interactive strategic planning was introduced to the Southwest Fisheries Center by Dr. Alexander Christakis (1984) of George Mason University using two major planning tools: the Nominal Group Technique (NGT) by Delbecq (1975) and Interpretative Structural Modeling (ISM) by Warfield (1974). This blend of interactive planning systems was chosen because of

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[3] This document is excerpted from: Samuel G. Pooley, 1993. A Honolulu Laboratory handbook on using the interactive approach to strategic planning. Unpublished manuscript.

Appendix D.--Continued.

success in planning sessions that involved both technical experts and key members of the public. We believe that structured group interactions stimulate cross-disciplinary creativity and promote a wider understanding of program priorities than either unstructured meetings or individualistic techniques.

These methodologies attempt to achieve consensus (not necessarily uniformity in thought but acceptance of the majority for planning purposes) in the identification of strategic priorities.[4] Consensus is accomplished by bringing together a wide variety of key stakeholders to develop a group identity, to stimulate creative thinking, and to develop structured output. The central feature to this methodology is its emphasis in building on human relationships amongst the participating stakeholders. As a result, the planning process is sensitive to the culture of the community of stakeholders within which priorities must be developed.

This approach to planning differs from "expert-based" approaches in that insiders, rather than outsiders, provide the <u>content</u> for the strategic priorities. It also differs from most committee-based planning approaches in that the <u>form</u> of the meeting is strictly controlled by the facilitator (in agreement with the decision-maker who calls for the planning exercise), but the <u>content</u> of the meeting remains entirely the result of the group's collaboration. We emphasize direct and equal communication with each participant and require democratic decision-making. Such structured discussion provides for a more productive result when the problem is complex and when the output must be an integration of multi-faceted inputs.[5] Finally, the <u>context</u> of the meeting is determined by the decision-maker who calls the meeting, subject of course to the interventions of stakeholders and the meeting participants.

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[4] Islei and Lockett (1991) argue that controversy and bargaining are central to group decision-making, and that rather than <u>forcing</u> consensus, the planning methodology must support a disaggregated approach to its inputs. From our perspective, "consensus" does not require that the planning participants be bound by the group results.

[5] "A team, in general, requires a more clearly defined framework than does an individual in order to complete a given task." (Islei and Lockett, 1991, p. 71)

Appendix D.--Continued.

This interactive strategic planning process usually involves the determination of three planning elements:

1) program objectives
2) constraints and barriers to action
3) program activities

In addition, the planning process may also develop a conceptual or logical "mapping", cross-linkages and groupings, and time-sequencing of these elements, as well as specific project descriptions, budgets, and time-frames. The planning process may also develop and utilize criteria for evaluating alternatives through formal modeling (Islei and Lockett, 1991, p. 71 ff).

These elements in the interactive strategic planning process are generally facilitated in the Southwest Fisheries Science Center by the following principles:

1) a structured discussion which allows an equitable voice for each participant at <u>each</u> step in the planning process (i.e., identification of objectives, determination of constraints, and development of activities) and which allows for substantive clarification of cross-boundary perspectives on the plan subject;

2) the development of consensus (either formal or casual) amongst the participants and the decision-makers on what should be the most important objectives and activities in the final plan[6];

3) a ranking and/or evaluation of program objectives, constraints, and activities. Rankings may be primarily *indicative* (rather than ultimately substantive) and are frequently used to delineate the order in which the activities are considered for sequencing. Rankings which involve a formal evaluation model may be warranted in some situations. I am increasingly concerned that the presentation of results from

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[6] "Consensus was important for many aspects of the decision process, but would have acted as an artefact if used as a means for establishing aggregate preferences." (Islei and Lockett, 1991, p., 75). We are not convinced that using the formal modeling approach recommended by Islei and Lockett is appropriate in situations involving external stakeholders in the planning process or in multi-disciplinary planning.

Appendix D.--Continued.

planning sessions not only capture the consensus viewpoint but reflect important differences as well.

This interactive approach intends to encourage discussion and group responsibility for the final product. However, it is the responsibility of the decision-makers to ensure there is adequate follow-up to the strategic planning process. Implementation is central, and commitment to implementation by the decision-maker is vital, not only for the strategic planning process to succeed but also to insure that the sense of community that is generated by the planning process is not thwarted.[7]

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[7] Implementation may involve the decision <u>not</u> to accept the recommendations of the planning participants or not to proceed on the program at all, but it is important that an explicit decision be made and that the reason for that decision be communicated back to the planning participants, including the external stakeholders.

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